WEF/WERF Cooperative Study of Nutrient Removal Plants: Achievable Technology Performance Statistics for Low Effluent Limits

Denny Parker[1], Charles Bott, HRSD, Jose Jimenez, Brown and Caldwell, Mark Miller, Virginia Tech, Sudhir Murthy, DC Water, JB Neethling, HDR, Amit Pramanik, WERF, Phil Zahreddine, EPA

[1]Brown and Caldwell
201 North Civic Drive
Walnut Creek, CA 94596
(Email: dparker@brwncald.com)

ABSTRACT

WEF and WERF cooperated in a comprehensive study of nutrient removal plants designed and operated to meet very low effluent TN and TP concentrations, several as low as 3.0 mg/L TN and 0.1 mg/L TP. The investigation also focused on the ability of nitrification technologies to meet low maximum day limits for ammonia. This effort focused on maximizing what can be learned from existing technologies in order to provide a database that will inform key decision makers about proper choices for both technologies and rational bases for statistical permit writing. Managers of 22 plants provided 3 years of operational data that were analyzed using a consistent statistical approach that considered both process reliability and the permit limits applied. A proposed set of quantitative descriptors were developed to describe the performance of BNR plants meeting stringent nutrient requirements in terms of effluent quality percentile statistics. Technology Performance Statistics (TPS) were defined as three separate values representing the ideal, median, and reliably achievable performance. Also, monthly average 95th percentiles of effluent data were used to compare the plants in terms of their ability to achieve the 3.0 mg/L TN or 0.1 mg/L TP criteria. Maximum day statistics were used to stratify the ability of plants to meet low maximum day permit levels.

KEYWORDS

Nutrient removal, nitrification, statistical reliability, permitting, nitrogen removal, phosphorus removal, limit of technology, technology performance statistics

INTRODUCTION

The Water Environment Research Foundation (WERF) Nutrient Challenge Research Program and the Water Environment Federation (WEF) cooperated in a comprehensive study of nutrient removal plants designed and operated to meet very low levels of effluent nitrogen and phosphorus. Both existing and new technologies are being adapted to meet requirements that are as low as 3 mg/L TN and 0.1 mg/L TP or lower, and there is a need to define their capabilities and reliabilities in the real world situation of wastewater treatment plants. In addition, it was noted that very low maximum day permit levels for Ammonia-Nitrogen were being seen in new